Developing a Layered Reference Model for Information

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Observations

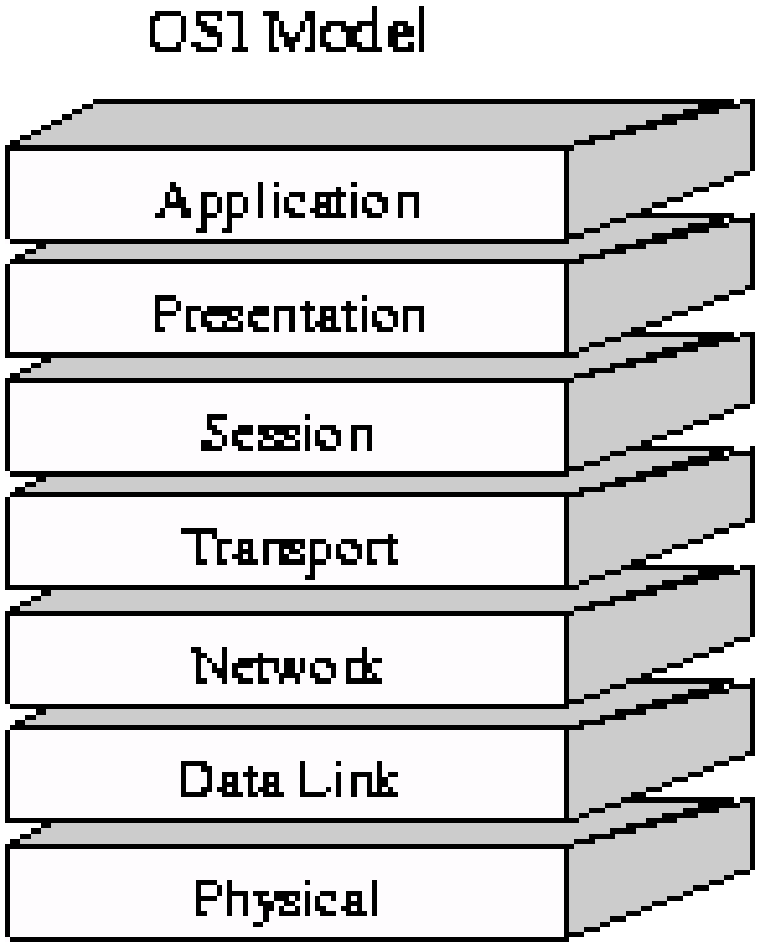
- Despite significant successes achieved in network connectivity, there remain significant discontinuities in today's product information systems
- That these discontinuities can be attributed to architectures that do not specify relevant information
- That there is a significant amount of ***implied*** instead of ***specified*** information

Some reasons why pertinent information is implied but not specified

- Information produced with narrow audience in mind
- Technological change – shift from paper-based to model-based
- Organizational change – downsizing, outsourcing, etc create discontinuities
- Tool driven – tools both enable and disable information exchange

OSI Model

a high-level, ‘reference’ model for networking



Tools

OS Interface

Network Services

Packets (TCP/IP)

Routing

Network Interface Hardware

Cabling

Example

Data Model Information

- Defintion: a model that describes in an abstract way how data is represented in an information system or a database e.g. STEP APs,
- e.g 3-D model in AP214 format retrieved from part library repeatedly fails when importing into MCAD tool
  - Problem: AP214 file generated from DIS model and this was not specified in header of AP214 file - - tool assumed all AP214 files are created equal
- This problem grows ten fold when dealing with proprietary data formats.
- Solutions: ALL DATA should include URI references to the data model used to create it. e.g. XML DTD/Schema URI reference at top of each file

Example

WBS information

- Definition:
  - A hierarchical breakdown of the work necessary to complete a project (NASA Systems Engingeering Handbook)
- Each piece of information created on a project has a WBS number associated with it but most do not include it
  - eg. MCAD models, Software (UML) models, Requirements Documents, Requirements models, Test Procedures, Test Results

Example

Product Structure Information

- Defintion: a functional relationship of those items used to make a product
- Each engineering domain (ME, EE, SE, etc.) historically uses domain-specific notation for depicting product structure:
  - MEs - drawing numbers, drawing trees
  - EEs - reference designators
  - SW - ??
- PDM systems can be configured to support multiple notations but this complicates implementations and does not directly address cultural differences

Example

Methodology

- Definition: systematic organization of rational and experimental principles and processes (Dictionary of Cybernetics and Systems)
- e.g. MCAD file is passed between contractor and prime integrator and tolerancing information is often implied but not specified in mechanical models –
  ie. constrained by MCAD tool specific tolerancing

Tolerencing information needs to communicate to a broad range of uses: Design Engineers, Systems Engineers, Production/Manufacturing Engineers, Process Engineers, Quality Engineer, Engineering Manager, Checkers, Engineering Consultant, Inspectors, Contractors, and others

Example

Semantic Information

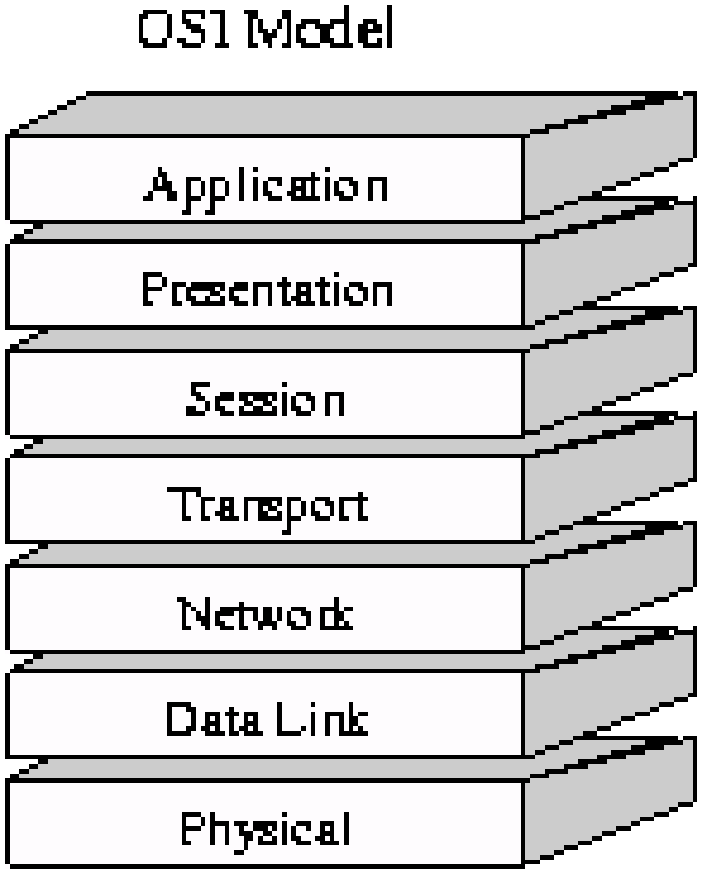
- Definition: the meaning or relationship of meanings of a sign or set of signs (Merriam-Webster)
- Meaning of over-loaded words that cross domains is often the source of miscommunication between engineering domains
- e.g. Electro-mechancial sub-system spec that uses words like “state” or “behavior” and don't specify the context in which the word is used; can be the source of confusion between mechanical, electrical and software domains.
- Semantics should be linked to data models that are available in data dictionary services

OSI Model

a high-level, ‘reference’ model for networking

Characteristics:

- Consistent level of abstrac
- Contains layers within laye
- Focus on function
- Vendor Independent



Tools

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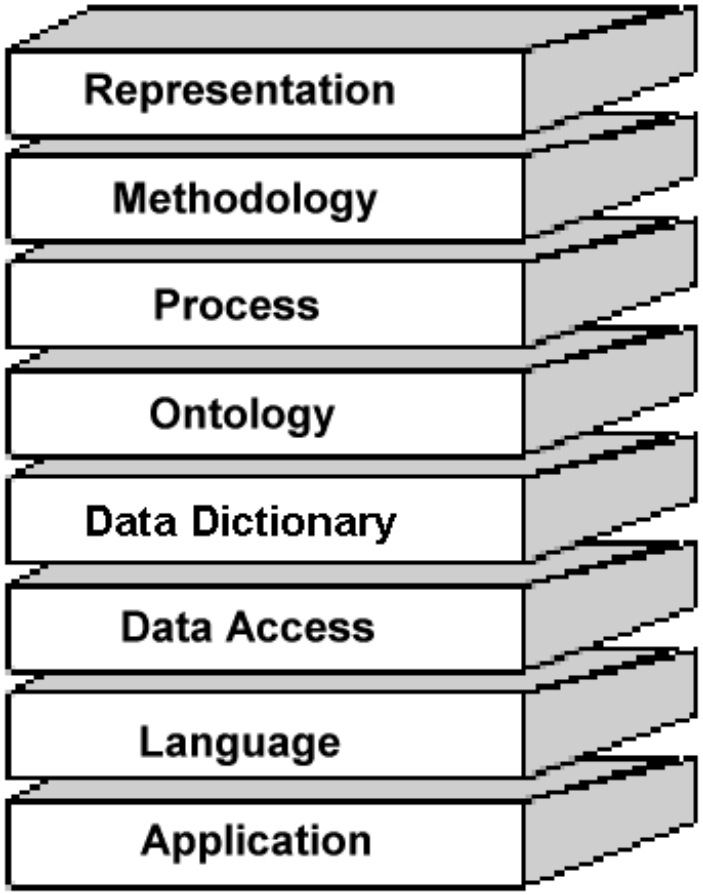
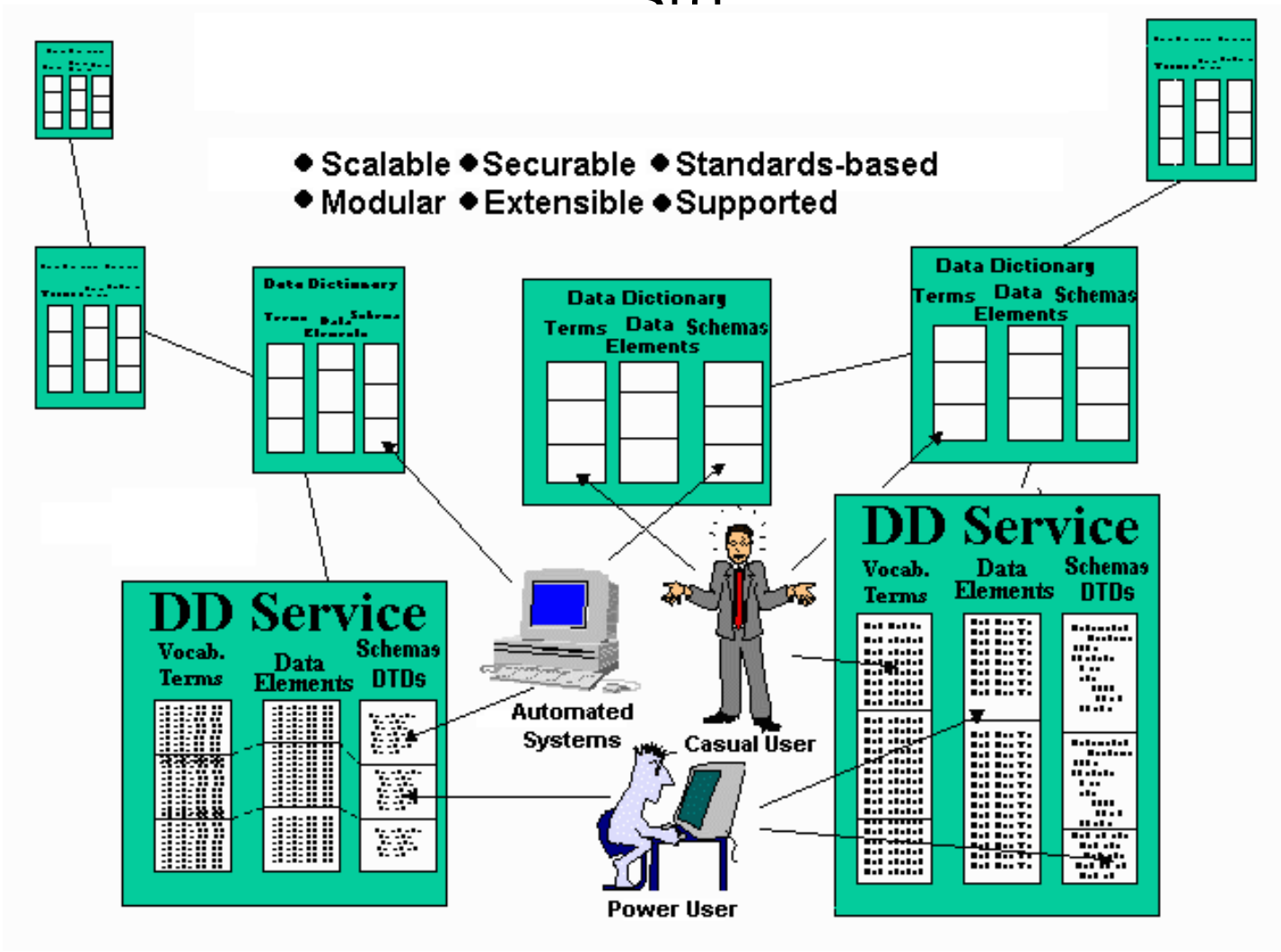
A Proposed Layered Reference Model for Information



how things are presented to user	e.g. XML, STEP P21/P28, VRML,
high-level approach	e.g. RUP, ROPES
step-by-step instructions	Organization/project specific
describes the relationships	e.g. OWL, SUO
describes the structures and semantics	e.g. PLIB, Rosetta Net, Athena,
how information is accessed (API)	e.g. MS COM, SOAP, OMG CORBA
what tools use to create data	e.g. UML, VHDL, ACIS, SDL, ParaSolid, Rose
tools used to create data	e.g. modeling, simulation, documentation, etc

Example of work on one layer of the Layered Reference Model

Distributed Data Dictionary Service based on LDAP Protocol and ISO 11179 Metadata Std



Summary

Crucial meta-data should not be implied, it must be specified to enable:

- exchange
- reuse
- Integration
- communication

Effective communication is severely restricted when end users must fill in the gaps and “potholes”

Standards-based Infrastructure services can be implemented to remove gaps and enable communication